

Chapter 3

EXISTING FLOWS OF MANUFACTURED GOODS

In this chapter we will examine some attributes of commodity flows into, through, and from the state of Indiana. The discussion will focus in large part on the nineteen commodity groups and two types of mail noted in the previous chapter. These are also the commodity groups that will be involved in the subsequent analysis, modeling, and forecasting of manufactured and other goods for Indiana. Databases for two other types of commercial traffic are available and are included here for completeness. The first of these is the movement of container traffic through East Coast ports that originated or terminated in Indiana. The second is the movement of solid waste that originates in Indiana and moves to various landfill sites in Indiana counties or nearby states.

All Commodities

Based on the 1993 Commodity Flow Survey, Indiana originated commodity flows valued at \$178.7 billion. These flows weighed in excess of 285.8 million tons. The major commodities involved in these moves in terms of value were transportation equipment (19.2%), primary metal products (9.8%), food and kindred products (9.5%), electrical machinery (8.9%) and chemicals and allied products (6.4%). The major products in terms of weight were slightly different: petroleum and coal products (21.9%), non-metallic minerals (20.1%), farm products (14.0%), primary metal products (9.8%), stone, clay and glass products (7.7%), food and kindred products (7.4%), and chemicals and allied products (4.2%) (see Table 3.1).

Destinations of Indiana Shipments

Data are not published at this time on the destinations of Indiana's commodity shipments as such. Data are published on the destinations for "all shipments."¹ For these data the major destinations in terms of value were Michigan, Illinois, Ohio, California, and Kentucky. The

¹The 1993 Commodity Flow Survey also looked at the transport of other goods (forest products, fresh fish, metal ores, petroleum, and ordnance) as well as freight forwarding activities. These were not included here because they are insignificant in Indiana (e.g., fish) or data quality was too inferior (e.g., petroleum).

Table 3.1 Value and Tonnage of Major Commodity Groups Originating in Indiana

STCC Code	Value (millions)	Tons (thousands)	Commodity Group
01	\$ 5,794	39,902	Farm Products
11	281	10,759	Coal
14	463	57,341	Non-metallic Minerals
20	16,958	21,039	Food and Kindred Products
22	275	93	Basic Textiles
23	7,795	553	Apparel
24	3,235	4,131	Lumber and Woods Products
25	3,120	734	Furniture and Fixtures
26	3,194	2,814	Pulp and Paper Products
28	11,474	11,957	Chemicals and Allied Products
29	9,008	62,500	Petroleum and Coal Products
32	2,748	21,972	Stone, Clay and Glass Products
33	17,485	27,881	Primary Metal Products
34	10,363	4,572	Fabricated Metal Products
35	9,504	1,023	Machinery, except Electrical
36	15,914	1,909	Electrical Machinery
37	34,401	6,731	Transportation Equipment
40	703	4,474	Waste and Scrap Material
50*	14,811	2,421	Other Manufactured Products

* Category 50 here includes STCC 21 (Tobacco Products), STCC 27 (Printed Matter), STCC 30 (Rubber and Miscellaneous Plastic Products), STCC 31 (Leather and Leather Products), STCC 38 (Instruments, including Medical and Photographic, as well as Watches and Clocks), and STCC 39 (Miscellaneous Products of Manufacturing). However, no data are included here for STCC 27 due to sampling and definitional problems regarding shipments in the 1993 Commodity Flow Survey.

major destinations in terms of weight were Illinois, Michigan, Ohio, Kentucky, and Louisiana. As one might expect, Indiana was the major destination of its own shipments in terms of value or weight. This is typical of most states.

Modal Choices

Mode choices for all shipments originating in Indiana were primarily truck (77.3% in terms of value), but it is considerably higher than that for some of the manufactured goods examined here as will be noted below. Parcel and express mail account for 7.1% (based on value) of the shipments and these are most likely all manufactured goods. Rail moved only 6.9% of the traffic based on value and 15.2% based on weight. Air freight (excluding parcels) and truck-air moves accounted for only 1.9% of the value and .05% of the weight moved. These numbers are not consistent with other national figures in part due to the nature of the data collected. The figures are based on traffic originating in Indiana. Traffic passing through Indiana (or the U.S.) or traffic originating outside the country are not included here.

Individual Commodities

In this section we will briefly examine the flows of the 19 sets of commodities and the two types of mail examined here. These discussions will focus primarily on flows terminating in Indiana, i.e., on the state's role as a consumer of manufactured goods. There is also some discussion of the state's role as a producer or shipper of goods. This is primarily an aggregate-level discussion, as opposed to a geographically disaggregated discussion, i.e., the focus is the state, not its counties. Much of the latter information would be based on the modeling done here and is less reliable, though certainly not unreliable, in comparison to the state-level data which is drawn from the 1993 Commodity Flow Survey.

Farm Products

Indiana receives the bulk of its farm products from itself. In 1993 these shipments were valued at \$2.5 billion (for 16.6 million tons). Illinois and Ohio were a distant second and third with shipments of \$309 million and \$213 million, respectively.

Aside from supplying itself Indiana exports farm products to other states valued at about \$3.3 billion. While a significant amount of farm products are exchanged with neighboring states, \$667 million finds its way to Louisiana. It is assumed that this is grain, probably corn, for export via the Gulf ports. Other major destination states are Georgia with \$312 million, North Carolina with \$217 million, Tennessee with \$156 million, and Alabama with \$135 million. Possibly all of these states use the grain for feeding poultry, but that is conjecture as the data are not refined enough to confirm this.

It is worth noting that although Indiana is viewed by many as an agricultural state, the farm products commodity category ranks 11th among the commodities produced here (see Table 3.1).

For Indiana's shipments of farm products the modal market is evenly split between rail and truck with about 42% each. Inland water picks up the remaining traffic; probably in the form of grain flows south over the Ohio-Mississippi River system.

Coal

Indiana shipped 10.7 million tons of coal in 1993, valued at \$281 million. Although the state has substantial amounts of coal, most of this has a high sulfur content. Environmental Protection Agency regulations result in low-sulfur coal be added to the Indiana coal to reduce the overall sulfur content per ton. This cleaner coal comes to the state from Colorado, Virginia, and Wyoming. Indiana's shipments tend to be to power plants in the state; it consumes 9.3 million tons of its own coal shipments.

Mode use for Indiana originated coal shipments is about 25% motor carrier and 75% railroad. This is unusual given that the average length of a one ton shipment is 85 miles.

Non-metallic Minerals

Non-metallic minerals as used here include stone, gravel, sand, clay, fertilizer and chemical minerals and miscellaneous minerals. Fuel minerals are excluded, but the group is very diverse. At \$11.58 per ton non-metallic minerals cannot cover the cost of long distance transport unless their value is on the extreme right end of this distributional mean. As a result Indiana consumes \$341 million of its \$463 million in shipments. It imports the remainder of its needs from neighboring states of Michigan, Illinois, and Ohio. On average, these minerals are consumed very close to their point of production; the average shipping distance for the state's shipments is 44 miles. Nationally this figure is 87 miles. Approximately 94% of the traffic that originates in Indiana moves by motor carriers.

Food and Kindred Products

Indiana receives the majority of its food and kindred products from itself. This amounts to \$7.6 billion in product value for approximately 9 million tons of goods. The other key origin states are Illinois (\$2.5 billion), Michigan (\$1.4 billion), Ohio (\$1.2 billion), and Kentucky (\$.9 billion). This illustrates the presence of regionally based manufacturing firms fulfilling localized demand.

As noted above Indiana is a major origin for shipments of food and kindred products to itself. It also ships 12 million tons of these products, with a value of \$9.3 billion to other states.

It is the third most important product, in terms of value, manufactured and shipped from the state.

Modal distribution of this product class is primarily accomplished by trucks over all distance ranges, but this mode is very dominant at distances less than 250 miles where the proportion of traffic using motor carriers is between 92% and 96%. Rail has a 40% market share at distances between 1500 and 2000 miles.

Textile Mill Products

Textile mill products are not among the state's major products, and it ranks third with its \$125 million in shipments to itself. More important as origins for shipments to Indiana are South Carolina (\$151 million) and Georgia (\$135 million), while slightly less important is North Carolina (\$106 million). The primary products here are clothing textiles, except for Georgia, which may represent primarily carpet fabrics.

Indiana only exports about \$150 million worth of basic textiles, this makes it the least significant of the state's manufactured goods.

This is primarily a motor carrier transported product with the percentage of the goods moved by this mode never falling under 92%. It is probable that the use of railroads for transporting textile mill products will drop from the picture completely in the next decade and recent forecasts have excluded it from analysis [1].

Apparel

Apparel destined for Indiana originates from across the United States, but approximately \$2 billion worth comes from Ohio. Indiana is the second highest supplier of its own demand with \$858 million, and California is third with \$520 million.

Indiana ships a significant amount of this product to other states. The value of these exports is a little less than \$7 billion, for 553 thousand tons. In general Indiana does not have a reputation as an apparel manufacturer, but its numbers in this area are impressive.

Motor carriers are the dominant mode again with these goods. Its proportions never fall below .95 of the market.

Lumber and Wood Products

Indiana has numerous lumber and wood related industries, primarily in the southern part of the state. The state is its own major supplier of these products, with \$1.5 billion in shipments in 1993. This represents more than 2.2 million tons of these products. A distant second as a

supplier of Indiana's demand is Kentucky with \$215 million in shipments to Indiana.

Indiana exported approximately, \$1.7 billion in lumber and wood product shipments outside the state in 1993 weighing 1.9 million tons.

Modal dominance belongs to motor carriers over all distance ranges except the 1000 to 1500 mile range and distances in excess of 2000 miles, where rail captures 55% and 67 %, of the traffic, respectively.

Furniture and Fixtures

Indiana's demand for furniture and fixtures is satisfied primarily by its own shippers and industries. This represents about \$605 million for 145 thousand tons of product. Michigan and North Carolina stand out as second and third in this supply chain with \$177 million and \$148 million, respectively.

Indiana exports substantial amounts of furniture and fixtures; these amounted to \$2.5 billion in shipments in 1993. The state has always had a reputation as a producer of furniture, but this industry is not as important as it once was.

Motor carriers move more than 97% of this product at distances less than 1000 miles. Rail picks up some traffic at longer distances, but shipments in excess of 2,000 miles represent only 6% of the total shipping market here.

Pulp, Paper, and Allied Products

Indiana is the major origin for a substantial amount of the pulp, paper, and allied products it received in 1993. These shipments were valued at \$1.3 billion. Other major supplying states were Illinois, Ohio, Wisconsin and Michigan.

An additional \$2.5 billion of this commodity group was exported by Indiana to other states.

Modal dominance in the pulp and paper industries rests with motor carriers, but railroads still move a substantial amount of product - in the 40% to 48% range - at distances beyond 750 miles.

Chemicals and Allied Products

There are significant amounts of chemical related products shipped to Indiana. Indiana supplies most of its needs in that regard with more than \$3.7 billion of its product going toward

satisfying its own demand. Illinois and Ohio are also among the lead states suppling Indiana, with \$2.02 and \$1.3 billion, respectively.

Indiana exports approximately \$7.7 billion dollars worth of chemicals to other states. This makes this commodity group one of the state's more important products.

Chemicals are transported by nearly all modes in this country. Motor carriers remain dominant up to about 500 miles, with railroads becoming dominant after that point.

Petroleum and Coal Products

Indiana is the primary supplier of its needs in the area of petroleum and coal products, which include goods ranging from gasoline to asphalt roof shingles. A little less than \$5 billion and 38 million tons of these products originate in the state. This does not mean that the coal of other states are missing from the raw materials used for these products; it means the production occurs here. Additional sources are Illinois (\$1.3 billion) and Ohio (\$259) million.

Shipments of petroleum and coal products to other states from Indiana are valued at \$4 billion in 1993. This represents about 24 million tons of product.

This commodity is moved primarily by motor carriers at distances up to 100 miles. This mode remains dominant up to 250 miles, but it begins sharing the products with both rail and water modes. Rail moves nearly 70% of these products at distances between 1500 and 2000 miles. A clear pattern does not emerge for water carriage simply because it requires the water to be where the shipments need to go, and this is often not the case.

Clay, Concrete, Glass, or Stone Products

These products are of generally low value and as a result are unable to absorb high transport costs. As a result the origins are usually nearby. Indiana is clearly the major satisfier of its needs with approximately \$1.1 billion and 16.3 million tons. Ohio supplies \$412 million dollars worth of products that weigh slightly more than 1.1 million tons. Pennsylvania and Illinois supply Indiana with \$153 million and \$148 million worth of products in this category, respectively.

Indiana ships more than \$1.6 billion of this product class to other states. This is probably crushed limestone or cut stone for the most part.

Motor carriers are the dominant transport mode for this group with nearly 100% of this commodity being moved by this mode at distances less than 100 miles. Its dominance continues through all distance ranges.

Primary Metal Products

As a major producer of iron and steel it is natural that Indiana should be able to satisfy a significant portion of its demand for primary metal products; the state supplies \$3.8 billion or 6.5 million tons of their demand for these products. This category also includes non-ferrous metal products, which are also produced in the state. Secondary sources of these products are Ohio (\$1.9 billion) and Illinois (\$1.5 billion) for 2.6 million and 2.8 million tons, respectively.

About \$13.6 billion worth of primary metal products are shipped from Indiana to other states. These shipments weighed more than 20 million tons in 1993. Indiana is a major supplier of this product to other states.

Modal dominance of this product's transport is held by motor carriers at distances up to 1,000 miles, beyond that rail is dominant reaching 61% in the 1,000 to 1500 mile range.

Fabricated Metal Products

When it comes to fabricated metal products, such as cans, tools, plumbing fixtures, bolts, nuts, wire and nails, Indiana supplies \$2.8 billion (1.4 million tons) of its demands. Once again the neighboring states of Michigan, Illinois and Ohio pick up the slack with about 1.2 million tons valued at \$3.1 million.

Indiana supplies \$7.6 billion in fabricated metal products to other states. These exports weigh in excess of 3.1 million tons reflecting a higher value product per unit of weight. This also explains the dominance of its movement by motor carriers over all distance ranges.

Non-electrical Machinery

Indiana supplies \$2.6 billion of its own demands in the area of non-electrical machinery, which includes everything from farm machinery to refrigeration systems. Other sources of note are Ohio (\$972 million), Illinois (\$923 million), Michigan (\$650), and California (\$340 million).

Indiana also ships a considerable amount of non-electrical machinery to other states. These exports were valued at \$6.9 billion in 1993. This is also a high-value good per unit of weight and this explains the modal dominance of motor carriers in its transport. This modal share never falls below 88%.

Electrical Machinery

Including everything from electrical wire to television sets and communication equipment, Indiana supplies much of its own needs. This amounted to \$3.2 billion or 566 thousand tons.

Other major supply states are California (\$996 million or 33 thousand pounds), Illinois (\$888 million and 73 tons), and Ohio (\$489 million and 50 tons).

State exports of electrical machinery were valued at \$12.7 billion in 1993. This represented about 1.4 million tons of product. Its unit value ensures that it will be transported by motor carriers over all distance ranges.

Transportation Equipment

Indiana supplies the bulk of its transportation equipment needs. These include all modes from motor vehicles to bicycles, including aircraft and ships. Obviously, Indiana does not manufacture some of these, at the same time it has no demand for some of these items. Indiana's supplies to itself are about \$5 billion in value for a total of 1.2 million tons. Other major suppliers are Ohio (\$2.7 billion), Michigan (\$2.7 billion), and Illinois (\$2.3 billion). Less important suppliers are New York (\$.7 billion), Missouri (\$.5 billion), Maryland (\$.5 billion) and Missouri (\$.5 billion).

Approximately \$29 billion worth of these products are exported from Indiana to other states. These exports weigh about 5.5 million tons. This is a product that could be moved by rail, but rail has little of the market share. It remains a product class moved primarily by motor carriers over all distances according to the 1993 commodity flow survey.

All Other Manufactured Goods

This collection of minor industries in terms of tonnages is referred to STCC 50 elsewhere in this report. It includes STCC 21 (Tobacco Products), STCC 27 (Printed Matter), STCC 30 (Rubber and Miscellaneous Plastic Products), STCC 31 (Leather Products), STCC 38 (Instruments including medical and photographic as well as watches and clocks), STCC 39 (Miscellaneous Products of Manufacturing). In general data for these industries are withheld due to sampling or disclosure problems. We will only note the major source for each of the components as published in the census commodity survey. Indiana supplies \$805 million of its own demand for tobacco products, most of these products would come from states where one or two firms dominate the industry and as a result their data are not disclosed. Printed matter runs into definitional problems. A weekly news magazine delivered to a home is the same as 10,000 copies of the magazine delivered to a warehouse for distribution; both are shipments. As a result no information has been published on this item. It is included in the STCC 50 category only for completeness.

Products of rubber and plastics are supplied primarily by Indiana, Ohio, and Illinois, although nearly every state supplies some of this product. Leather products are so minor in value and tons that much of their data are withheld. The instruments category is supplied by Indiana,

Illinois, California and are valued at \$874 million, \$618 million, and \$299 million, respectively. The final category here includes items from jewelry to silverware to artists supplies. For Indiana's demand most of the shipments of this final set come from Indiana (\$935 million) and Ohio (\$221).

It will be recalled that this category was assembled from several groups that were not among the state's dominant industries. As a result, the group is very heterogeneous. This probably explains its strange pattern of mode use. Shorter distances are primarily handled by motor carriers with rail becoming important between 750 and 1500 miles along with a nearly 13% mode share going to air transport. Beyond 1500 miles we again see motor carriers as dominant. One should not over analyze these mode shares that are created by grouping diverse industries. They are fine for analysis purposes.

Waste and Scrap Material

The transport of waste and scrap material is a somewhat controversial topic; environmentalists would prefer if Indiana did not import any waste. However, much of what is included here is actually going toward recycling.

Some components of this commodity, (e.g., ashes) are unlike any other commodity examined here. It is a product which the shipper wants to give away, but usually ends up paying the consumer to take. This being the case the shipper clearly wants to minimize the transportation cost on the shipment. At the same time nearby consumers do not always want to acquire the product, even if they are paid to do so. Other components have economic value, e.g., metal scrap, that can be recycled. All of this creates some rather strange circumstances for flow modeling.

Indiana consumed an estimated 5,848,000 tons of waste and scrap in 1993. Slightly more than 2 million tons of this came from the state with the remainder coming from elsewhere. The elsewhere in this case is Illinois (1.1 million tons), Michigan (.4 million tons), Ohio (.7 million tons). The state also receives waste from Pennsylvania, Wisconsin, Kentucky and Missouri.

Indiana is not just a receiver of waste and scrap. It actually produces 4.5 million tons of this waste. About 2.5 million tons is shipped to other states by Indiana: .7 million tons to Illinois, .3 million tons to Pennsylvania, .2 million tons to Ohio, and small amounts to several other states.

The dominant transport mode for waste and scrap shipments is the motor carrier with 54% of the traffic. Rail is second with 30% of the market, and Inland Water follows this with a little more than 5% of the market.

Mail and Delivery Systems

For many small communities in the United States the only regular motor carrier traffic is the arrival of a U.S. mail contract motor carrier. These communities may also see the occasional overnight express delivery truck, e.g., FedEx, UPS, Emery, DLH, and so forth. If the items being sent are economic goods in the sense of a manufactured product or a retail item, these were included implicitly in the 1993 Commodity Flow Survey as such a good shipped by parcel and delivered by any of the aforementioned services or the U.S. mail. There are some exceptions to this statement; these are printed matter. Books, magazines, newspapers, and the like were not included in the survey. We would like to try and capture this traffic.

Also not included in the 1993 survey was just the regular mail. Included here would be the letter from home, the weekly news magazine, an item from a book club, catalogs, bills, or junk mail. Although the quantity is measurable very few of us can quote the pounds of mail we get per week or month. At the same time the U.S. Postal Service is not willing to release such data. We must estimate its amount and the method of doing this is discussed below.

The growth of express or overnight delivery services has been nothing short of phenomenal in the last decade. As noted above, economic goods shipped in this manner are generally included in the study (except for printed matter), but non-economic goods are often missed. Perhaps a major component of this category would be manuscripts between universities, law firms, corporations, and the like. There is some irony that the express mail delivery service has grown along with electronic mail, but this may say something about the quality of the latter during its early years. Exactly how much is being moved by these express mail carriers is generally unknown and such information is proprietary. We will also try to estimate this flow component here.

U.S. Mail

Although the U.S. Postal Service does not generally release information on mail it does release information on postal revenues for selected cities. A 1991 release of this information indicated a postal revenue rate per capita that ranged from \$131.80 for Los Angeles to \$1092.50 for Atlanta. Taking the lowest value and assuming this is accumulated at the rate of 32 cents per ounce results in 412 pieces of mail per capita per year or about 1.4 ounces per day (298 delivery days assumed). Annually this is about 25.7 pounds per family member. This is the expansion factor that was used on the population of the 145 areas examined here to estimate mail traffic. The conversion of this to delivery vehicles will be explained later.

Express Mail

Private corporations involved in express or overnight mail are a bit more secretive than

even the U.S. Postal Service. Some of the corporations involved in this sector have their own fleet of aircraft and this provided the basis for our estimation procedure. The largest of the overnight delivery service companies is FedEx (formerly Federal Express). This company flies into a number of small communities where it appears to be the only delivery service reaching these locations by air. Examining several of these small communities revealed that their cargo weighed about 3.6 pounds per capita for the community served. It is generally stated in the trade literature that FedEx has approximately 53% of the overnight delivery service. Expanding the 3.6 pounds to account for the remaining 47% of the market reveals a delivery rate of 6.8 pounds for all such services annually. This was the expansion factor applied to population to estimate express mail traffic.

Container Traffic

Some data are available on the movement of goods by container between Indiana and East Coast ports. Indiana also receives and ships containerized traffic through West Coast ports, but data are not available on these flows. This study has not examined container flows as such. It simply regards these as rail or truck flows from Indiana to the various export states and whether the good is enclosed in a trailer or container is not explicitly of interest to the highway traffic situation, which is the focus here.

Nevertheless, the container flows available for East Coast ports indicates an overwhelming export dominance for Indiana's industries. Containerized exports weighed 104 thousand tons in comparison to imports of 53 thousand tons. Actual containers in this situation were 14.5 thousand for export and 6.3 thousand for import. The map on the following page (Figure 3.1) illustrates containerized exports and imports by county for Indiana.

The contents of the various containers is proprietary. The density of goods may be of interest to researchers. This density factor is 8.48 tons per container for imports and 7.15 tons per container for exports.

Indiana Solid Waste

In contrast to the earlier discussion of waste and scrap, most solid waste has no economic value. As a result the transportation of this waste is done in such a way as to minimize cost. Data on the movement of solid waste in Indiana are collected by the Indiana Department of Environmental Management (IDEM) from each solid waste facility in the state. The reports are prepared quarterly for each landfill or transfer station and give the total solid waste tonnage received, as well as the components of this tonnage, i.e., municipal waste, construction waste, and other waste. Other waste includes items such as rubber, sludge, and medical waste. The data used here were compiled from individual reports submitted to the Indiana Department of Environmental Management for the year 1991.

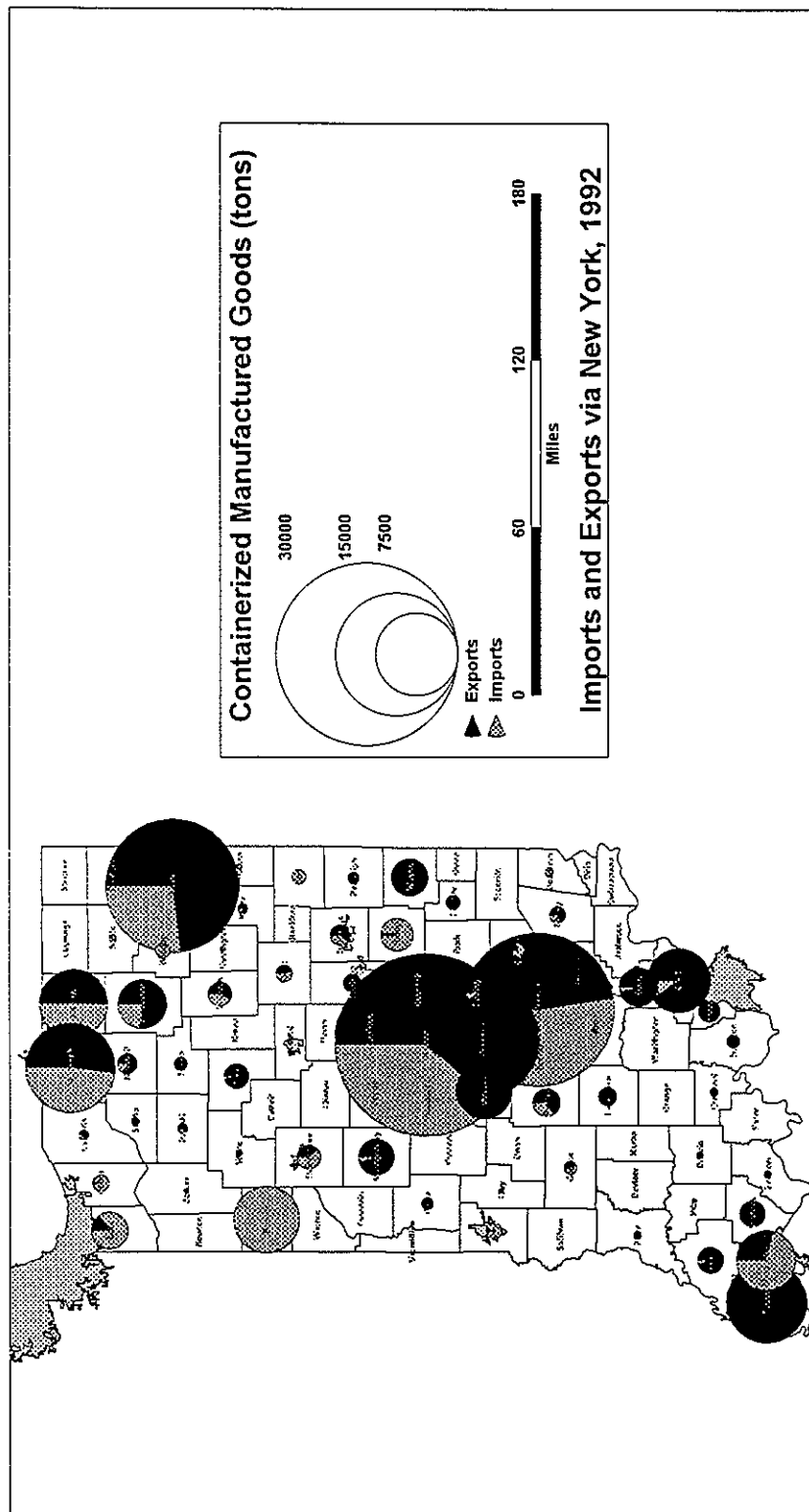


Figure 3.1 Containers Imported and Exported from Indiana's Counties, 1992

Productions and attractions of total solid waste by county in Indiana were analyzed to determine correlates of these variables for the counties of Indiana ($N=92$). Although a detailed analysis involving numerous variables was undertaken the findings of this research were not that surprising. Sixty-three percent of the variation in solid waste production (correlation coefficient or $r = .79$) is statistically explainable by the magnitude of population in the county where the waste is produced. The waste attracted to each county is a function of the landfill space available there; eighty-five percent of the variation in total waste attraction can be explained by this variable ($r = .92$). Although the components of solid waste were compiled separately, it is probably sufficient to collect only data on municipal waste in future studies since it is highly related to total waste ($r = .995$).

Figure 3.2 is a map of the actual origins and destinations, sometimes called desire lines, for the movement of total solid waste in Indiana from generating locations to landfills.

Data on solid waste flows and its components are usually impossible to find for research purposes. It is for this reason that the county level data collected for this project are reproduced in an appendix of this final report. Researchers interested in working with this data should contact the author for additional details.

Intermodal Traffic

There is considerable interest today in traffic shipments that are intermodal. Without a doubt this area has seen significant growth over the past two decades and the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 was in part a response to that growth. Barriers to efficient transport were seen as quite significant to the movement of this traffic by the drafters of ISTEA. A complete discussion of intermodal transport is beyond the scope of this report and intermodal transport problems in Indiana are being addressed elsewhere in a study by Booz Allen and Hamilton. Nevertheless, a brief discussion of the importance of this traffic is merited here.

It is probable that the major intermodal traffic of Indiana passes through the state as part of the "land bridge" between Asia and Europe. Shippers on these latter continents have found it efficient to move manufactured goods in containers by ocean transport to the East and West Coasts of the U.S. and then cross the North American continent by rail. Railroads have entered into agreements that allow the blocking of entire trains of containers, thus eliminating the need to move this traffic through congested railroad classification yards. Competitive alternatives to this routing would take smaller container ships through the Panama Canal or larger container ships around the southern edge of South America. This traffic has little economic significance for the state since it is overhead rail traffic. It does explain the heavy volume of traffic on the northern Indiana east-west rail lines.

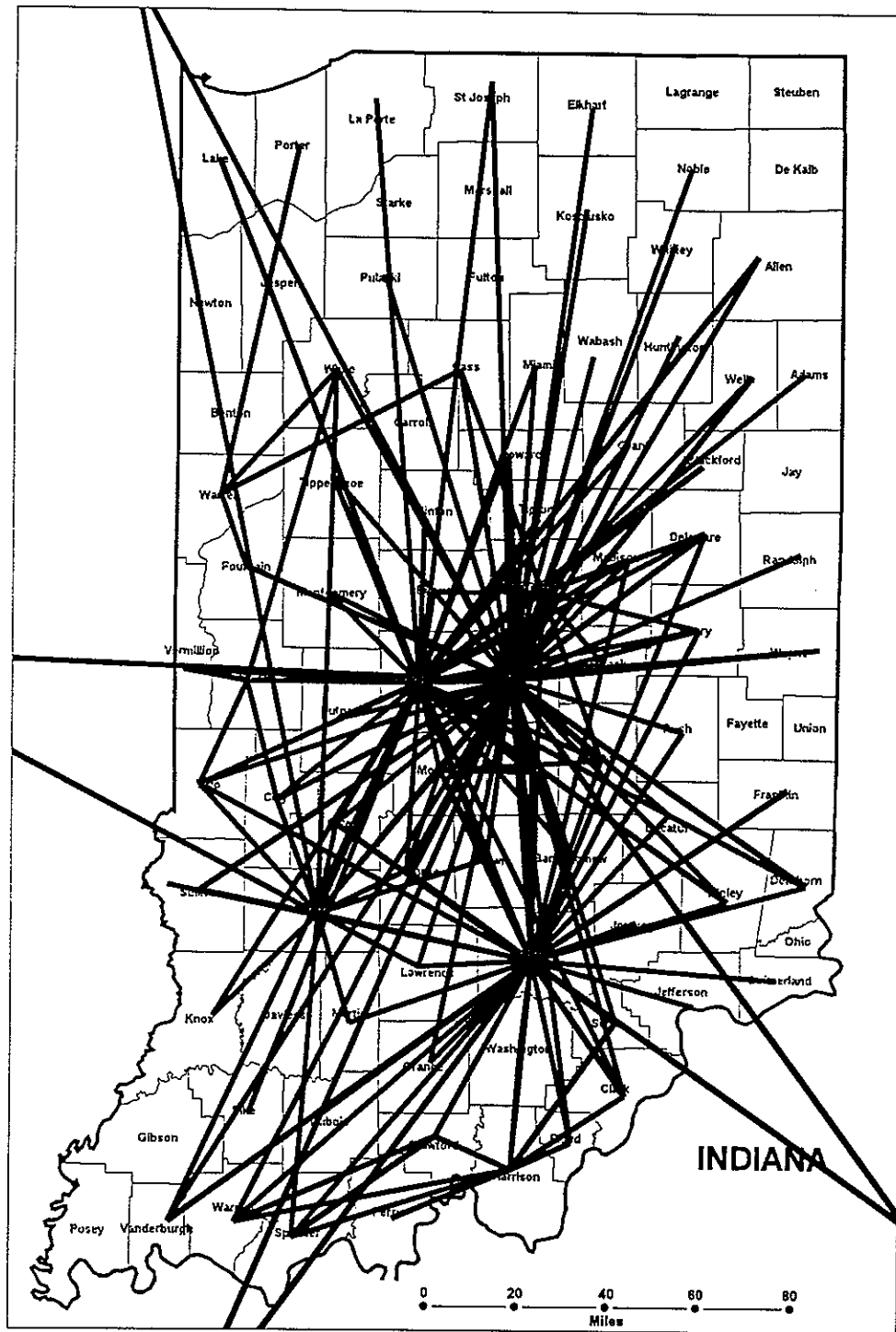


Figure 3.2 Desire Lines of Solid Waste Flows Between Generators and Landfills

These high volumes of the "land-bridge" are not apparent in the data presented in this report. Recall that the 1993 Commodity Flow Survey is shipper-based and since the shippers in each case are located outside the U.S., the flows are not included in the survey.

For Indiana as a whole intermodal transport is practically insignificant according to the 1993 flow survey. In terms of tonnage, intermodal traffic represented less than a quarter of one percent of the total. This is looking at truck-rail, truck-air, and truck-water moves. If we throw in private truck-for hire trucks as intermodal, the percentage climbs to just under 1.25. Intermodal traffic volume represents about 3.6% of the total traffic originated in the U.S.

If we look at the value of goods the numbers increase as one would expect. In this case intermodal traffic has 3.2% of the total shipment value in Indiana. For the nation this statistic is 4.7% of the total shipment value. Nearly half of these values come from intermodal truck-air transport.

Data disclosure problems prevent complete discussion of intermodal traffic by commodity for Indiana. Published data on the value of shipments originating in the state suggest that truck-air moves are the most important for shippers of machinery of all types (STCC 35 and STCC 36) and transportation equipment (STCC 37). In both cases it is quite likely that the item being transported would be parts, rather than machinery or vehicles.

Intermodal Facilities in Indiana

If we look around the state there is considerably more intermodal traffic than the 1993 data would suggest. We could categorize all parcel traffic as intermodal (the commodity flow survey did not), since it usually involves at least truck and air. This sector accounts for 7.1% of the value of shipments, but less than 2% of the tonnage.

The major intermodal facilities in Indiana can be broken down into three sets: water ports that require a change of mode from water carrier to truck or rail (or vice versa), airport based facilities involving air-motor carrier intermodal traffic, and rail transfer facilities where traffic is interchanged between truck and rail or rail and truck. The first of these facilities involves bulk goods, the second involves parcels, and the third involves usually containerized manufactured/consumer goods. Let's examine each of these.

The Ports

The Southwind Maritime Center is located in southwestern Indiana on the Ohio River. It is the largest of Indiana's ports in terms of total tonnage (inbound and outbound). This high tonnage is due in large part to the high volume of coal it handles. This was 3.3 million tons in 1993 according to data compiled by IUPUI in 1994. The origin of this coal is not known, but it

may have come from the Rocky Mountain deposits over the Missouri, Mississippi, and Ohio Rivers. Once it arrives in Indiana it is probably transferred to rail or motor carrier for movement to its final destination.

Other major commodities that contributed to the 4.9 million tons handled in 1993 were grain (1.2 million tons), and fertilizer (271 thousand tons). The grain is most likely destined for areas of the lower Mississippi River for export abroad.

Burns International Harbor on Lake Michigan ranks second in terms of tonnage handled. As can be seen in Table 3.2 on the following page, the major commodities passing through the port's facilities are steel and primary metals (39.6%), coal and coke (17.5%) and grain (13.5%). Once again, details on the breakdown of this tonnage between inbound and outbound is not available.

The smallest of Indiana's ports is Clark Maritime Center on the Ohio River on the Indiana side of the Louisville metropolitan area. Total traffic through the port was 1,406,599 tons in 1993 according to an IUPUI study. The breakdown of traffic was grain (79.2%), dry fertilizer (13.0%), gypsum (2.7%), salt (1.6%), steel and steel coil (1.4%), and all other (2.1%). The Clark facility is undergoing significant growth and its traffic between 1992 and 1993 nearly doubled. However a large part of this growth is attributable to a significant increase in corn yields.

In nearly every case above the traffic arriving or departing from these ports is in bulk form. This would suggest that shipments come from their Indiana origins or arrive at their Indiana destinations as rail moves. All three ports have on-dock rail facilities and are able to handle containers as well. Exceptions to this general statement might include some steel imports and exports that could go to their final destinations by motor carrier. It is also conceivable that some grain destined for shipment out of the state might be trucked to facilities near these ports.

There are several other private ports that handle traffic on Lake Michigan and the Ohio River. The former include: Inland Steel, LTV Steel and USX Steel. Data are not available on their operations, but it is reasonable to assume that they receive iron ore and export steel. Some coal may also come in over the lake. Other river ports include the two private ports of Mulzer Stone Company, one at Newburgh and the other at Evansville. It is assumed they import and export stone and stone related products.

Airport Facilities

All air freight traffic would appear to be intermodal since it usually arrives or departs from the airport via motor carrier. The state has some major traffic centers in this category. One of these is the FedEx facility at Indianapolis, there are probably several others. Other facilities

Table 3.2 Burns International Harbor Traffic, 1993

Commodity	Tonnage	Percent
Liquid fertilizer	87,735	3.8
Dry fertilizer	12,552	.5
Potash	113,843	5.0
Coal/coke	400,266	17.5
Silicone ore	4,072	.2
Limestone	120,217	5.2
Pig iron	40,993	1.8
Specialty ore	43,054	1.9
Slag	68,971	3.0
Salt	52,504	2.3
Grain	310,349	13.5
General	130,588	5.7
Steel & primary metal	908,278	39.6
TOTAL	2,293,422	100.0

receiving air freight include Indianapolis International Airport, Hulman Regional Airport (Terre Haute), Michiana Regional Center (South Bend), Fort Wayne International Airport, and Evansville Regional Airport. Indications are that air freight facilities at Chicago, Louisville, and Cincinnati also serve portions of the state. Data were not explicitly examined on these air freight facilities since air freight was not examined as a single mode in this study, but rather as a mode that also used highway transport as part of its moves.

Intermodal Rail Facilities

There is significant ambiguity when it comes to identifying the importance of different rail-truck intermodal facilities in the state. On the one hand most data available are not detailed enough to examine the question. Some data sources, that appear reliable, yield traffic data that are not consistent with expectations, e.g., the carload waybill sample. It does appear that the major rail-truck facilities in Indiana are as listed below:

Norfolk Southern Triple Crown Facility, Fort Wayne
General Motors Roanoke Facility, near Fort Wayne
Toledo, Peoria and Western's (BN-SF) Hoosier Lift, Remington
Conrail's Avon Yards, west of Indianapolis
CSX, Evansville

As can be seen from this list the facilities are controlled by individual companies and the data tend to be proprietary. Data are available in the public use waybill sample, but even these data yield nonsensical results in comparison to known facts.

Summary

The various commodity groups (excluding the mail services, containers, and solid waste) that are included in this study of traffic flows represent 93.7% of the value of all products shipped from Indiana and 93.9% of the value of all products shipped in the United States according to the 1993 Commodity Flow Survey. In terms of weight the commodity groups represent 98.9% of the originating tons in Indiana and 96.0% of the originating tons nationally based on the same 1993 survey.

In terms of commodity shipments this study is very comprehensive. Aside from the commodities left out because they are not very significant for Indiana, there are a few other flows worth noting. The discussion of containers in this chapter notes that we have little information on import flows to Indiana from abroad. This is because the 1993 Commodity Flow Survey is shipper based and (for obvious reasons) only shippers in the U.S. were surveyed. Therefore, we get exports from Indiana, but we get no imports since the shippers of these are in foreign countries. We take a step toward solving this problem later in the report.

There are other components of the traffic stream that are not examined here. One of these is household moving vans. Twenty percent of the population in the U.S. moves each year and many of these use established moving companies. Data on these companies were once compiled by the Interstate Commerce Commission; it is not clear that data are compiled on individual moves, but it may be possible to estimate this from the decennial census.

A second component of the commercial vehicle traffic stream not examined here is service transport. Armored trucks moving bank receipts, tow trucks moving disabled vehicles, carpet cleaner vehicles, commercial laundry vehicles, construction vehicles, plumbers, lawn care vehicles, and many more are included in this service transport sector. It is a sector that has all but been ignored by transport planners, yet these are the commercial vehicles that make urban area arterials significantly more congested than rural arterials. If such vehicle moves are addressed at all in urban transportation studies, they are frequently handled by a growth factor (e.g., ten percent additional vehicles to account for trucks) or as a component of traffic counts (e.g., ten percent of the flow is trucks). This data shortcoming is far beyond the scope of this study to correct. It should be addressed first at the national level by a group such as the Transportation Research Board, which could undertake an examination of common practices by state transport planning agencies.

These are relatively minor components for a study of interstate and intercounty commercial transport flows involving Indiana. One can feel confident that the major non-local commercial vehicle flows are included here.

Although specific data on intermodal freight transport are important to any study of this type, the quality of these data leave much to be desired. The *1993 Commodity Flow Study* gives us very little to go on at the state level. One could say it is useless at this level even though the data categories are there. Data are not released because of disclosure problems or sampling problems. The Carload Waybill Sample covering rail traffic is also all but useless at this level of detail. Although this study had access to some proprietary data from the waybill sample, it is still a sample and substantial amounts of traffic are missed at this level. Expansion factors do not work well if a single waybill covers traffic via a unit train to a rail-truck intermodal facility. In addition, conversations with rail officials would suggest that there is some ambiguity regarding what constitutes an intermodal unit, e.g., if we have two twenty-foot containers on a single flat car, is this one unit, or two units? The containers should be counted, but this does not appear to be the case based on data we have seen. Clearly improvements are necessary in the data available in this area.

References Cited

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